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AN APPRAISAL SURVEY OF SPRUCE BUDWORM DAMAGE ON PARTS
OF THE BOISE AND PAYETTE NATIONAL FORESTS IN SOUTHERN
IDAHO. NOVEMBER, 1954

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Summary.

During 1952, spruce budworm infestations flared up on some 500,000 forested acres on the Boise and Payette National Forests in Idaho. Since then, damage has continued to be severe and some top killing and tree killing has occurred. The amount of defoliation which has occurred during the years 1952, 1953 and 1954 was observed and sampled in November, 1954. Aerial spraying of 623,000 acres is being considered during next summer as a method of controlling the spruce budworm outbreak.

The following observations pertain to the infestation:

1. Except for several older outbreaks on the Boise N. F. the infestation is 3 years old.
2. Damage varies from light to heavy within the boundary of the infestation.
3. Another year of defoliation may result in a substantial increase in top killing in areas of severe defoliation.
4. Areas reported to have sustained actual tree killing were not accessible at the time of the survey.
5. It is not expected that natural factors will effect a reduction of damage in 1955 although slight improvement was noted in one drainage on the Payette N. F.
6. Control of the infestation by use of aerial sprays would serve to prevent tree mortality, increment loss and bark beetle attacks in weakened trees.

Introduction.

During the period November 10-19, 1954 a survey of spruce budworm, *Choristoneura fumiferana* (Clem.), damage was conducted on the Boise and Payette National Forests in Idaho by the Division of Forest Insect Research. Those participating were: W. E. Cole, M. M. Furniss, L. N. Garner, and R. I. Washburn. The survey was undertaken in order to establish the trend of the infestation since 1952 and to determine the seriousness of the 1954 defoliation. The essential information in this report was made available soon after the survey in order to aid in the planning of aerial spraying operations which, if done, would be scheduled for June and July, 1955.

History of present infestation.

We owe our knowledge of the history of the infestation to annual reports ^{1/} of forest insect conditions in the Intermountain area written by L. W. Orr following creation of the Ogden Forest Insect Laboratory in 1949. Although the annual reports contain rather general accounts of the spruce budworm infestation, they serve to show that a marked increase in the infested area and severity of damage was visible in the summer of 1952.

During 1950 and 1951 the acreage infested by the spruce budworm was not indicated but the damage was rated as moderate to severe. In the summer of 1951 it appeared that top killing might take place in some areas in another year or two. The following summer brought with it an alarming increase in the infestation and the Payette N. F. was mentioned for the first time. It was reported that approximately 500,000 acres of fir stands were damaged on the Boise and Payette National Forests to a degree visible from the air. Although very little tree killing occurred, the understory trees were damaged severely. Areas noted to be especially hard hit on the Boise N. F. were stands south and west of Atlanta, drainages emptying into the North Fork of the Boise River, the upper part of the South Fork of the Payette River drainage, Clear Creek drainage north of Lowman, and the Deadwood River drainage. On the Payette N. F., aerial observations resulted in detecting five areas of heavy defoliation. Three of those were west of Council on the headwaters of Hornet Creek and Crooked River. The others were on the Weiser River northwest of Starkey and just east of Pollock.

In 1953, Orr reported no change over the previous year except that many intermediate and overtopped trees were dying or dead. The areas in which killing occurred were not extensive, however. The most severe damage observed from the air was in the Big Creek drainage within the Wilderness Area on the Payette National Forest.

A report was not prepared after the 1954 season but observations and data collected during November indicate that the spruce budworm continued to cause damage equivalent to or heavier than the previous two years.

While the infested area apparently did not increase appreciably, there was no indication that damage would diminish in the foreseeable future.

Description of areas.

During late summer, 1954, P. A. Grossenbach and M. M. Johannesen of Timber Management mapped from the air infestations on the Boise and

^{1/} Forest Insect Conditions in the Intermountain Region 1950.
L. W. Orr, Forest Insect Laboratory, Ogden, Utah. Mimeographed.
Other reports with the same title were prepared in 1951, 1952, and 1953.

and Payette National Forests. The acreages used in this report were determined from maps prepared during their flights.

The Payette N. F. contains two infestations estimated to cover 114,000 acres (see map). In terms of severity of damage, the area is divided into 21,000 acres of heavy defoliation, 40,000 acres of moderate defoliation, and 53,000 acres of light defoliation. These infestations are divided geographically by the little Salmon River. The more serious outbreak lies to the west of the river and is called the Cuprum area in this report. The infestation lying east of the river is referred to as the Pollock area and appears smaller in area and less serious. W. E. Cole and M. M. Furniss conducted the survey of damage on the Payette N. F. As indicated on the map, it was possible to achieve a fairly good distribution of observations and samples in the Cuprum and Pollock areas.

The infestation on the Boise N. F. is estimated to extend over 514,000 acres. Of this total, 26,000 acres are reported to be heavily damaged and the rest about equally divided into light and medium damage. Reaching into the spruce budworm infestation from the west is an extensive area of ponderosa pine which recently harbored a spectacular infestation of the pine butterfly. During control operations against the pine butterfly in 1954, adjacent mixed pine and fir stands were sprayed also. The spruce budworm in the mixed stands was observed to have been greatly reduced although the spraying was timed primarily to kill the butterfly on the pine. The spraying, of course, had no effect on the main spruce budworm infestation lying outside the control boundary. L. N. Garner and R. I. Washburn conducted the survey of spruce budworm damage on the Boise N. F.

Methods.

Sampling was done across contour, as from creek to ridge. For the most part, sampling stations were approximately 10 chains apart but the interval varied on the Boise N. F. Each station was selected by pacing a standard distance from an arbitrary stopping point. Trees from which branches were cut were selected in order of their proximity to the sampling stations. Pole pruners which were 16 feet long were employed to cut the branches at a level in the crown of approximately 20 feet above ground. Because sampling was done at a height of 20 feet, the smallest tree sampled was about 25 feet tall. One branch was selected from each of 4 sides of trees having full crowns. If a tree had a one-sided crown, 4 branches were cut on the side having foliage. After securing enough branches, 200 growth terminals were examined, 50 from each branch whenever possible, and the number of 1954 terminals which were over 75% defoliated was recorded as a percent of the total. For example, if 30 of a 50 bud sample were over 75% defoliated, 60% was recorded for that sample.

The standard of 75% defoliation is consistent with that used during similar surveys conducted by personnel of the Coeur d'Alene, Idaho Forest Insect Laboratory. It is believed that less than 75%

defoliation has little or no influence on tree growth although there seems to be no proof to substantiate or refute that belief. Until further information is available, acceptance of 75% defoliation as the division between significant and inconsequential damage will at least serve to standardize survey procedure and facilitate comparison of results.

Additional trees were selected and sampled until the average percent defoliation of 200 terminals taken from any two of them agreed within 20%. It never required more than four trees to obtain the arbitrary standard of agreement and generally only two were needed.

It was apparent during the survey that the system of sampling until the damage of any two trees agreed within 20% might better be replaced with a sequential system of sampling. Sequential sampling is simply a means of getting a reliable estimate with the minimum number of samples. However, its derivation requires previous measurement of the thing to be sampled. The problem of measuring budworm damage is likely to persist and it is probable that a suitable system of sampling will be developed.

The damage to 1952 and 1953 terminals on the same branches was classed as light, moderate or heavy without attempting to assign quantitative values in order to determine the trend of damage since 1952. The form used in recording these data is attached.

Separate information concerning tree mortality was gathered from both National Forests in areas of especially heavy damage. On the Boise N. F. a 200 tree sample was used and 1/10- and 1/5-acre circular plots were used on the Payette N. F. All trees over 3 feet tall were tallied by species, size and severity of damage.

Results.

In most areas, damage is heaviest on true fir. Douglas-fir is second in order of severity of defoliation while Engelmann spruce ranks last. A total of 143 trees was sampled for damage to 1952, 1953, and 1954 foliage. Of the 143 trees, 60% were true fir, 24% were Douglas-fir and 16% were Engelmann spruce (Table 4). The percentages of each tree species included in the sample of the Boise N. F. and the Payette N. F. were about the same. However, it is not known whether the percentage of each tree species in the stands is the same as the percentage of each tree species in the sample.

I. Payette National Forest

An examination of the results from both National Forests suggests that the Cuprum infestation on the Payette N. F. is slightly more intense than the others at the present time. A cruise of 5 small plots in Indian Creek revealed 40% of the host trees were top killed but complete killing was not encountered (Figures 1 and 2). Similar damage was observed at Lost Creek and Boulder Creek as the result of

3 years of severe defoliation. Elsewhere within the Cuprum area the trend of damage since 1952 is clearly upward. There is no indication of appreciable defoliation prior to 1952 and this fact leads to the conclusion that it is still a young outbreak with no sign of relief in sight.

The situation in the Pollock area on the Payette N. F. seems considerably better in some areas than was reported following the aerial survey. No budworm damage was found in three of the four drainages sampled (Table 1). However, the Hat Creek (sometimes called Hay Creek) drainage displayed heavy damage but 1954 foliage was defoliated slightly less than that of 1952 and 1953. Whether this is only a momentary interruption in an upward trend is not known.

The tentative boundary of the Cuprum infestation which was determined by aerial observation was found to be drawn accurately in all instances except at the end of the road near Boulder Creek. Apparently the infestation continues a mile or so more eastward than was observed from the air. The accuracy of the assumed boundary of the Pollock infestation is in doubt, however. The infestation is known to be in Hat Creek and Rattlesnake Creek drainages but observations elsewhere indicate that the true acreage may be much less than reported. It is recommended that an effort be made next spring to better define the Pollock infestation.

II. Boise National Forest

Winter weather had already made about one-half of the infested area inaccessible at the time of the November survey. The Graham unit was among those areas previously reported to be heavily defoliated but which could not be reached. However, on the basis of the limited amount of data which were obtained, the general picture on the Boise is perhaps slightly better than was anticipated. A sample of a heavy infestation at Pikes Fork contained less than 1/2% top killed trees (Figure 3). Although the average defoliation in 1954 (Tables 2 and 3) is comparable with that encountered on the Payette N. F., the upper range of defoliation is noticeably less. It may be that this fact explains in part why repeated partial defoliation has resulted in no mortality and only slight top killing in the areas examined on the Boise N. F. At any rate, this infestation is evidently several years older than that on the Payette N. F. However, there is no evidence as yet to indicate that its end is in sight. The general upward trend in damage during 1954 leaves no choice but to assume that the infestation will continue and perhaps at an accelerated pace.

Discussion:

The survey described in this report does not provide sufficient information to completely evaluate the major spruce budworm infestations on the Boise and Payette National Forests in Idaho. Many areas such as Graham on the Boise N. F., reported to have sustained heavy damage, were inaccessible at the time of the survey. Furthermore, estimates of overwintering spruce budworm populations which serve as a measure of expected future damage will not be available until next spring.

Figure 1. A white fir, typical of top-killed trees recorded on sample plots along Indian Cr., Cuprum Area, Payette N. F.

Figure 2. Nobs at the ends of this white fir branch resulted from defoliation of 1954 terminals. Indian Cr., Cuprum Area, Payette N. F.

Figure 3. The irregular branching of this top-killed Engelmann spruce resulted from repeated defoliation of new growth. This is the only top-killed specimen found among 200 trees sampled at Pikes Fork, Boise N. F.

In spite of these limitations, certain use may be made of the data. For instance, there is a clear indication of a continuing upward trend of damage in the Cuprum area. Top killing, already evident in the heavier parts of the infestation, is expected to increase next year unless prevented by control action.

The Pollock infestation seems less extensive than was thought to be the case. Further examination of this area is needed before its acreage and status can be determined with certainty. Limited observations suggest that 1954 damage slackened a little in the Hat Creek drainage from a high level in 1952 and 1953. The reasons for this improvement should be studied.

The infestation on the Boise N. F. is large and diverse, making generalizations meaningless. In parts of this area, including Graham and Deadwood, the infestation has been observed since 1950. However, the infestations in the Trinity Mountain and Atlanta units appear of more recent origin, probably beginning in 1952. The trend of damage in all areas on the Boise N. F. seems to be slightly upward. The relative absence of top killing encountered during the survey may not adequately describe conditions in the inaccessible heavily infested units. However, it is interesting to reflect upon the situation at Pikes Fork where a small sample indicates that less than 1/2% of the host trees have been top killed after 3 years of heavy defoliation. Even so, it may well be that next year is the crucial one and extensive top killing may suddenly occur as the result of cumulative defoliation.

Recommendations.

Control of these infestations by aerial spraying should be considered if the overwintering larval populations are found to be sufficient next spring to cause heavy damage to the 1955 foliage. Assuming that the fate of the tops of damaged trees lies in the balance, application of insecticide next summer would forestall a tremendous amount of top killing in the heavily infested areas. Control of surrounding lighter infestations at the same time would keep the spruce budworm out of the critical areas and hold down the trend elsewhere. The increase in volume growth should be substantial and the improved vigor of trees in all areas following control would do much to prevent bark beetle outbreaks in the weakened trees.

Table 1.--Summary of spruce budworm damage to 1952, 1953 and 1954 terminals in the Pollock and Cuprum areas, Payette National Forest. November 1954.

Area and Strip Name	^{1/} 1952	^{1/} 1953	^{2/} 1954			No. of Trees
			Ave. (%)	Range (%)	No. of Terminals	
Cuprum						
1. Sheep Cr.	L	L	49	2-100	4200	21
2. Indian Cr.	L	L	47	9-94	3400	17
3. Boulder Cr.	L	H	64	7-98	1200	6
4. Lost Cr.	H	H	80	39-100	1200	6
Pollook						
5. Hat Cr.	M	H	67	19-99	2600	13
A. Hazard Cr.	}	No damage was found.				
B. Lake Cr.						
C. Elkhorn Cr.						
TOTAL					12,600	63

1/ Defoliation during 1952 was classified as follows:
L = Light, M = Medium, H = Heavy.

2/ 1954 defoliation is expressed as the average percent of 200 1954 terminals more than 75% destroyed.

Table 2.--Summary of spruce budworm damage to 1952, 1953 and 1954 terminals on the Boise National Forest. November 1954.

Strip Name	<u>1/</u> 1952	<u>1/</u> 1953	<u>1954</u> ^{2/}		No. of Terminals	No. of Trees
			Ave. (%)	Range (%)		
6. Wilson Cr.	L	L	62	36-80	1800	9
7. Scott Mtn.	L	L	42	20-83	3000	15
8. Sunset Ridge	L	L	37	2-71	2200	11
9. Pikes Fork	H	H	62	29-87	1600	8
10. James Cr.	L	L	50	25-90	3200	16
11. Trinity	L	L	20	0-56	4200	21
TOTAL					16000	80

1/ See footnote Table 1

2/ " " " 1

Table 3.--Number of trees per defoliation class sampled during survey of spruce budworm damage on the Payette National Forest and Boise National Forest, Idaho. November 1954.

Defoliation : Class (%)	Area : Cuprum Pollock		Total : Payette : N. F.	Wilson : Cr.	Scott : Mtn.	Sunset : Ridge	Pikes : Fork	James : Cr.	Trinity	Total : Boise : N. F.	Total : Payette N. F. & Boise N. F.
0-10	5					3			8		
11-20	8	1			1	1			4		
21-30	2	1			5		1	2	6		
31-40	5	1		1	1	1		3			
41-50	4			1	4	3	1	5	1		
51-60	2	2		1	1	2	1	2	2		
61-70	7	1		3			2				
71-80	1	1	24	3	2	1	1	2	14	38	
81-90	4	4			1		2	2			
91-100	12	2									
TOTAL	50	13	63	9	15	11	8	16	21	80	143
%70% Defoliated	34	54	38	33	20	9	38	25	0	18	27

Table 4.--Number of trees and tree species ^{1/} sampled during survey of spruce budworm damage on the Payette National Forest and Boise National Forest, Idaho. November 1954.

Forest & Area	True fir	Douglas-fir	Engelmann spruce	Total
Payette N.F.				
Cuprum	33	11	6	50
Pollock	9	1	3	13
Sub-total	42	12	9	63
%	67	19	14	100
Boise N.F.				
Wilson Cr.	4	5	0	9
Scott Mtn.	6	4	5	15
Sunset Ridge	3	8	0	11
Pikes Fork	5	0	3	8
James Cr.	9	4	3	16
Trinity	17	1	3	21
Sub-total	44	22	14	80
%	55	28	18	100
Grand Total	86	34	23	143
%	60	24	16	100

^{1/} The proportions of tree species in this table bear no known relationship to the actual proportions in the stands from which damage samples were obtained. The species composition shown here are included because the spruce budworm shows apparent preference for true fir, followed by Douglas-fir and then Engelmann spruce. For instance, a sample composed exclusively of Engelmann spruce will invariably indicate less severe damage than a sample composed entirely of true fir.

SAMPLE

AREA Cuprum STRIP Lost Cr. CREW MMF - WEC DATE 11-15-54

PLOT NO. 1 (of 5) FOREST Payette

TREE NO.	BRANCH	1952	1953	1954	REMARKS
1	a	L	H	20	
W.F.	b	M	H	30	
12"	c	L	H	25	
	d	L	H	35	
TOTAL				110 = 55%	
2	a	L	M	40	
E.S.	b	L	M	35	
10"	c	L	M	30	
	d	L	M	35	
TOTAL				140 = 70%	
3	a				
	b				
	c				
	d				
TOTAL					
4	a				
	b				
	c				
	d				
TOTAL					

L = Light, M = Moderate, H = Heavy
W.F. = White fir
E.S. = Engelmann spruce
D.F. = Douglas-fir